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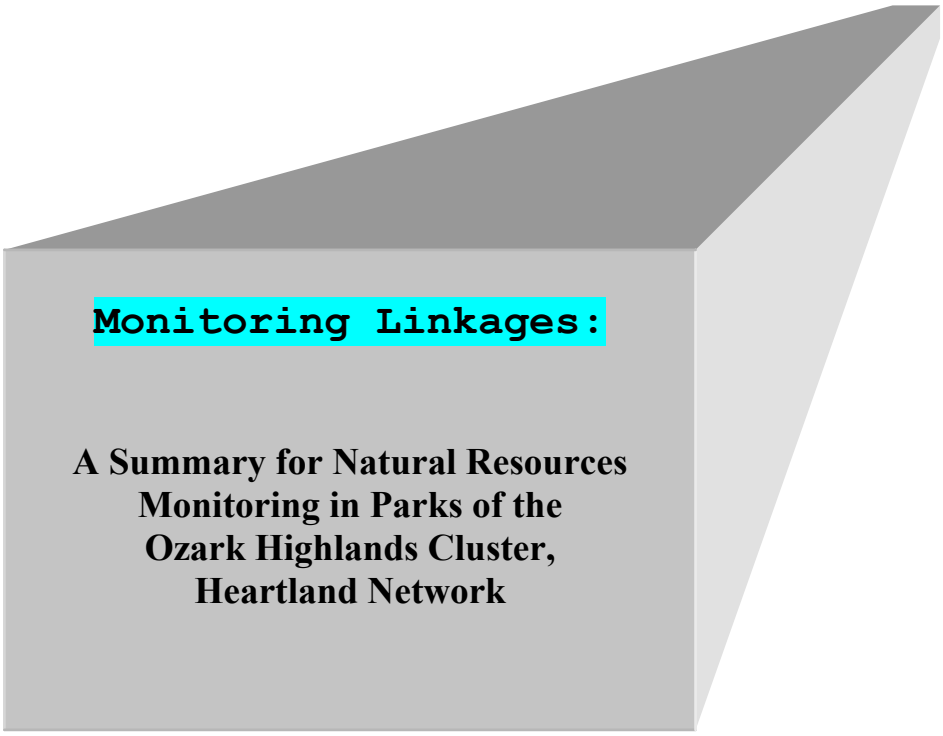


Monitoring Linkages:

A Summary for Natural Resources Monitoring in Parks of the Ozark Highlands Cluster, Heartland Network

A component of the
Inventory and Monitoring
(I&M) Program,
National Park Service

October 2000

Introduction

Knowledge about the status and trends of natural resources within National Park Service (NPS) areas across the nation is surprisingly incomplete, despite the fact that the NPS has been in operation for over 80 years. At many NPS areas, basic presence/absence information of park flora and fauna has never been collected, and robust trend data is rare. This situation presents a problem to those implementing the Natural Resources Challenge, an NPS initiative whose objectives include integrating natural resource inventory and monitoring information into management planning and decisions.

Successfully obtaining this inventory and monitoring information, therefore, is a key objective of the Natural Resources Challenge. The method proposed to accomplish this objective is expanding and facilitating the use of the NPS Inventory and Monitoring (I&M) Program, within all parks containing significant natural resources. Parks across the nation meeting this criterion were grouped into 32 "networks", whose boundaries roughly align with ecoregion boundaries (Bailey 1995), or in some cases, groups of ecoregions. This national array of networks streamlines the mechanism of conducting inventories and monitoring in areas with similar resources, and thus where similar protocols could be used.

The **Heartland Network** is one of the largest of the 32 networks, representing 3 ecoregions and 8 states, with a geographic area of approximately 500,000 square miles (Figure 1). There are 15 park areas within the Heartland Network. To facilitate inventory and monitoring efforts, these parks have been further organized into three **"clusters"**, denoted by the ecoregion in which they lie: Tallgrass Prairie, Ozark Highlands, and Eastern Hardwood Forest.

Figure 1. Parks of the Heartland Network

(Lisa, could you replace with the "poodle" map here?)

The task of designing a dual program to provide both missing inventories and needed monitoring for parks within these clusters has rested primarily with natural resource personnel within the network. In particular, since October 1999, the staff of the NPS Tallgrass Prairie Long-term Ecological Monitoring Program (Prairie Cluster LTEM) has provided a competent and cohesive program to guide the Heartland Network in developing this program. In September 2000, a document entitled "*A Study Plan to Inventory Vascular Plants and Vertebrates: Heartland Network, National Park Service*" was completed, and described the efforts to address the **inventory** needs within the network.

Efforts are now ongoing to address the monitoring needs within the network. The focus of this document is to summarize the **monitoring framework** for those parks within the Ozark Highlands Cluster.

The Ozark Highlands Cluster

There are six park areas within the Ozark Highlands Cluster (the cluster), all of which are located within Missouri or Arkansas (Table 1). The parks range in size from 210 acres to over 95,000 acres. Parks within the cluster are generally of two shapes: smaller compact areas, which lack significant buffer areas, and larger, yet linear areas, which are subject to significant edge effects.

Table 1. Parks of the Ozark Highlands Cluster, Heartland Network

Park	Code	State	Size (acres)
Arkansas Post National Memorial	ARPO	AR	389
Buffalo National River	BUFF	AR	95,730
George Washington Carver National Monument	GWCA	MO	210
Hot Springs National Park	HOSP	AR	5,549
Ozark National Scenic Riverways	OZAR	MO	82,196
Pea Ridge National Memorial Park	PERI	AR	4,300

The resources contained within these parks represent a wide variety of natural communities and societal events, including the Revolutionary War, the Civil War, geothermal springs, the Carver homestead, Mississippi Valley settlements, caves, and spring-fed rivers.

Water quality and hydrology are critical natural resource issues for these parks, as is the challenge of watersheds that extend beyond park boundaries. Karst topography, with the resultant spring and caves, forms another unique feature of the region. The hundreds of caves within the parks provide habitat for gray, Indiana and Ozark big-eared bats. In addition to oak-hickory woodlands, the Ozark Highlands parks possess unique habitats that range from xeric grasslands (glades and savanna) to wetland communities (seeps, fens, springs). The parks are managing savannas, woodlands and open fields with prescribed fire. BUFF supports the only elk herd within the Ozark Highlands and contains 7,000 acres of designated wilderness area. The parks include a large number of state and federally-listed threatened and endangered species, including endemic and relict

populations. Management of exotic plants and animals presents a challenge to both the cultural and natural values of the parks.

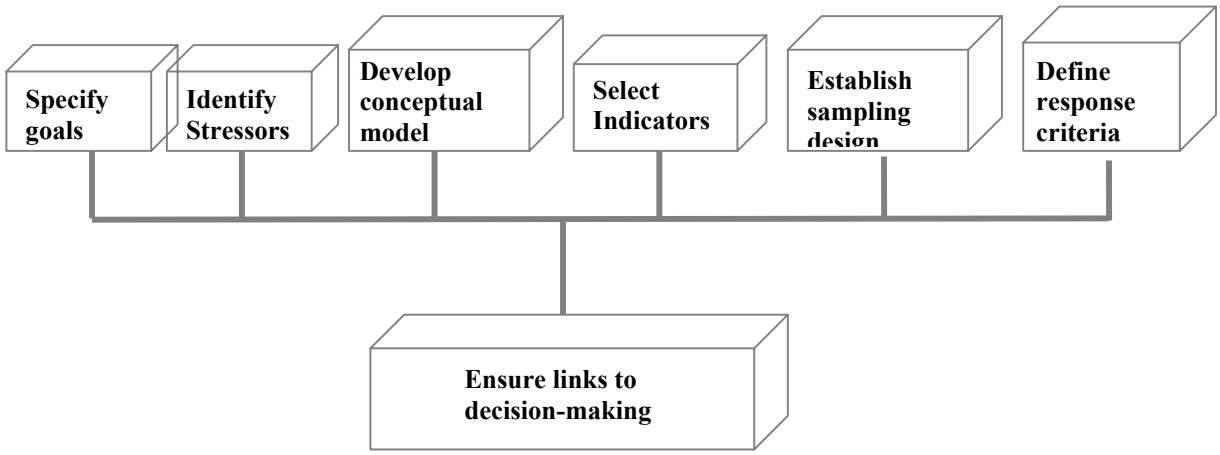
The Natural Resources Monitoring Assessment Process, to Date

Monitoring is the "measurement of environmental characteristics over an extended period of time to determine status or trends in some aspect of environmental quality" (Suter 1993). Analysis of the data from monitoring activities can identify trends and place sidebars on natural resources conditions and processes. These insights feed directly into the pro-vs-con analysis conducted during management discussion and decisions.

But which resources or processes should be monitored? Determining this for each park area is a site specific assessment process, and can involve a complex and iterative blending of congressional mandates, public values, institutional limitations, and the state of scientific knowledge. Representatives of the 15 network parks met during a workshop in March 2000 to start this very difficult process.

To guide the workshop participants, Prairie Cluster LTEM staff proposed the Heartland Network follow the first four of the six steps outlined by Noon et al. (1999) for the development of a monitoring program (Figure 2).

Figure 2. Steps in the design of a monitoring program (from Noon et al. 1999).



During the workshop, 19 taxa experts brainstormed with park resource managers to consider the most significant park resources, current and future stressors (including threats & management actions), and potential indicators for monitoring . The identified significant resources within the cluster are summarized in Table 2. These significant resources, along with information about their stressors, effects of the stressors, and potential indicators were incorporated into a conceptual model (Tables 3a and 3b).

Table 2. Most significant resources of the Ozark Highland Cluster.

Ozark Highlands Cluster (ARPO, BUFF, GWCA, HOSP, OZAR, PERI)	
the river and its tributaries	old-growth hardwood/pine stand
high quality riverine resources	glade/post oak barrens communities
seeps and springs	oak hickory forest
Geothermal springs	deer herd
bayous and river	Waterfowl
cave ecosystems	cave fauna

After this process, each park resource manager was asked to rank the relative value of potential monitoring projects, by significant resource type, for the Cluster. The method and criteria used to develop rankings is described in the Analytic Hierarchy Process (Peterson, et al. 1995). The ranked scores are summarized in Table 4.

The top three project areas identified (by point average) by the four compact area parks are geothermal springs, river integrity (biotic), and plant communities within unique habitats, followed by amphibian breeding habitat, invasive exotics (distribution), and river integrity (abiotic).

The top three project areas identified (by point average) by the two linear river parks, BUFF and OZAR, are river integrity (biotic), river integrity (abiotic), and threatened/endangered species, followed closely by land use change, springs, and plant communities in unique habitats.

From these priorities, a pattern of target natural resources monitoring area within parks of the Ozark Highlands Cluster emerges, which focuses on:

- **aquatic resource quality**
- **unique/endangered plant communities and animal occurrences**
- **invasive exotics**

Cluster Monitoring Approach

A working group of park, regional, and LTEM staff within Heartland Network defined the following goals for vital signs monitoring:

1.) determine the status and trends of the health of park ecosystems,
2.) establish normal limits of variation in park resources,
3.) provide early warning of resource decline,
4.) evaluate the effectiveness of resource management practices, and
5.) develop a predictive understanding of environmental change.

Table 3a. Conceptual model of stressors and their potential effects on park resources: Ozark Highlands Cluster, Riverway Parks (BUFF and OZAR), Heartland I&M Network.

STRESSOR	RESOURCE	EFFECT	POTENTIAL INDICATORS
Natural Disturbance			
Flooding	River Resources	Flooding as flush of river system	recharge area dynamics
Drought	Springs/ River Resources	Loss of species, concentration of pollutants	spring flow
Drought	Forest Plant Communities	Loss of drought-intolerant species, increased fire severity	overstory competition, 100-hr fuel moisture
Adjacent Development & Landuse			
	River Water Quality	Is the biotic integrity of the river being maintained?	macroinvertebrate assemblages, fish/turtle diversity, etc.
	River Water Quality	Is the abiotic integrity of the river being maintained	water chemistry, flow, turbidity, etc.
Livestock grazing	River Water Quality	Is water pollution associated with adjacent livestock grazing increasing/decreasing?	fecal coliform levels, fecal coliform standard violations, nutrient loading, algae abundance
Septic/sewage effluent	River Water Quality	Is water pollution associated with sewage treatment increasing or decreasing?	
Agri-chemical runoff	River Water Quality	Is water pollution associated with agricultural runoff increasing/decreasing?	
Erosion from clear-cutting	River Water Quality	Is land clearing on steep slopes adjacent to the park altering aquatic or biotic communities within park boundary?	sedimentation rates, loss of silt-intolerant species
Water pollution	Herpetofauna	Are amphibian and reptile populations stable?	change in diversity &/or abundance over time
Gravel-mining	Streambed structural integrity, water quality	Is gravel mining resulting in increased turbidity and sediment loads, channel armoring, channel instability, and loss of macroinvertebrate diversity?	rate of channel movement, geomorphic cross-sections, macroinvertebrates
Lead-mining	Watershed	Is underground mining causing underground movement of lead through karst aquifers? Is there bioaccumulation of heavy metals up through the food chain?	Tissue assays from fish, sediment cores from stream bottom, heavy metal water assays

Table 3a, cont'd. Conceptual model of stressors and their potential effects on park resources: Ozark Highlands Cluster, Riverway Parks (BUFF and OZAR), Heartland I&M Network.

STRESSOR	RESOURCE	EFFECT	POTENTIAL INDICATORS
	Watershed	Are blowing dust from tailings piles, failing of tailing ponds, and treatment non-compliance resulting in accumulation of heavy metals?	Tissue assays from fish, sediment cores from stream bottom, heavy metal water assays
Road management	River Water Quality	Is road management causing increase in sedimentation/pollution from road chemicals?	Sedimentation rates, loss of silt-intolerant species,
HazMat transport & spills	River Water Quality,	Are hazmat accidents resulting in fish kills, population declines, water and soil pollution?	No. of spills, hydrocarbon pollutant assays, permitted sites, fish abundance/diversity
Development -- Diversion of Flow	River Water Quantity	Is landuse within the watershed changing the quantity of water flowing through the river(s)?	hydrology, stream flow
Ground water pollution	Caves, seeps, springs	Is development adjacent to the park affecting communities within caves, seeps, and springs, given karst geology?	loss of habitat-specific flora/fauna, decline in bat populations
Fire Suppression	Plant Communities	Is the change in fire cycles from 3-5 yrs to 50-100 yrs. (fire suppression) causing loss of native species and exotic encroachment?	Plant community composition, loss of fire-tolerant species, increase in fire intolerant species
Fragmentation			
Exotic Invasion- gypsy moths	Forest communities	Are gypsy moths present in the park? How is forest composition changing as a result?	gypsy moth traps, forest community composition
Invasive exotic plants	Unique plant communities	Are exotic plants displacing native species in unique plant communities?	distribution, size of exotic patches, composition of unique plant communities
Utility & road corridors	Plant communities	Are utility and road corridors acting as invasion corridors for invasive exotic species?	changes in plant community composition, loss of native diversity
Utility & road corridors	Wildlife populations	Are utility and road corridors acting as barriers for colonization/migration, or decreasing the effective size of habitat areas?	aerial photography, fragmentation index
Climate Change/ Global Warming			
	Unique plant communities	Will global warming alter the make-up of glade/barren communities?	Change in plant community, loss of species, change in reptile species (i.e. collared lizard)

Table 3a, cont'd. Conceptual model of stressors and their potential effects on park resources: Ozark Highlands Cluster, Riverway Parks (BUFF and OZAR), Heartland I&M Network.

STRESSOR	RESOURCE	EFFECT	POTENTIAL INDICATORS
	River	Will climate change and global warming change the hydrologic character of the river?	
Recreation			
Horseback riding	Riparian zones, water quality, unique habitats	Is horsetrail use impacting park resources?	vegetation associated with recreational use areas (i.e. cane brakes), fecal coliform levels
Boating/camping	Water Quality	Are waste water and boat fuel impacting river water quality?	
	Unique plant communities, cave resources	Is camping along the riverway impacting sensitive natural areas?	
Caving	Caves and troglobitic fauna	Is caving negatively impacting caves and troglobitic fauna?	loss of diversity/abundance of troglobitic populations
Management			
Prescribed Fire	Glade/savanna communities	Is prescribed fire maintaining savanna-type communities?	plant community composition
Prescribed Fire	Glade/savanna communities	Is prescribed fire regime increasing species diversity (esp. conservative taxa)?	conservative plant & animal species diversity
Old-field Management	Old fields	Are actions to promote open fields for wildlife increasing diversity?	diversity of mammals, birds, insects.
Old-field Management	Fishless ponds	Is old-field management affecting amphibian breeding grounds around fishless ponds?	calling surveys to estimate diversity and abundance of amphibians
Old-field Management	Canebrakes, Swainson's warbler	Is old-field management enhancing/degrading canebrakes, (habitat for Swainson's warbler)?	size and distribution of cane brakes; calling surveys for Swainson's warbler
T&E Habitat Management	T&E species (cave, grotto, dark-sided salamanders)	Are T&E troglobitic fauna populations stable?	abundance estimates
T&E Habitat Management	T&E bat species	Are T&E bat populations stable?	abundance estimates
Stream-bank stabilization	Riparian zone	Are stream-bank stabilization efforts successful in reducing stream bank erosion?	height, length of eroded bank, photo-points

Table 3b. Conceptual model of stressors and their potential effect on park resources: Ozark Highlands Cluster, Small Parks (ARPO, GWCA, HOSP, PERI), Heartland I&M Network.

STRESSOR	RESOURCE	EFFECT	POTENTIAL INDICATORS
Adjacent Development			
Deer overabundance	woodland plant communities	Are deer impacting plant community dynamics/diversity	Woody seedling and sapling density; plant community composition, browse line
	deer	Is the deer population stable, increasing/decreasing?	Spotlight or aerial survey to determine abundance
Agricultural runoff	stream/river/bayou water quality	Is there an impact on water quality from agricultural run-off	Algae, bacteria
Water pollution	stream/river/bayou water quality	Does stream/river water quality meet EPA standards?	Aquatic macroinvertebrates, fish community, water chemistry
Water pollution	herpetofauna	Are amphibian and reptile populations stable?	Change in diversity &/or abundance over time
Water pollution	cold-water springs	Do the cold water spring meet EPA's Clean Water standards?	Water chemistry, bacteria, isotopes, short-term storm event effects
Water pollution	geothermal springs	Do the geothermal springs meet EPA's Clean Water standards?	Water chemistry, bacteria/cyanobacteria, isotopes, short-term storm event effects
Water pollution, water usage	geothermal springs	Are the geothermal springs changing with regard to physical/chemical parameters	Flow regimes, watershed hydrology, water chemistry, temperature, turbidity
Predation by feral animals	small mammals & birds	Are domestic/feral cats & dogs impacting small mammal/bird populations?	Changes in small mammal/bird populations
Fragmentation			
Exotic invasion	plant communities	Are exotic plant species displacing native species	Distribution and rate of spread of exotic patches, plant community composition
Loss of riparian corridors	riparian corridors, stream banks		Rate and spread of erosion
Loss of adjacent habitat	old-growth hardwood/pine plant communities	Is the old-growth hardwood/pine community healthy?	Plant community composition

Table 3b, cont'd. Conceptual model of stressors and their potential effect on park resources: Ozark Highlands Cluster, Small Parks (ARPO, GWCA, HOSP, PERI), Heartland I&M Network.

STRESSOR	RESOURCE	EFFECT	POTENTIAL INDICATORS
Management			
Mowing	Native and restored prairie communities	Is haying regime healthy for the prairie?	Plant community composition, habitat heterogeneity, small mammal diversity, nesting grassland bird diversity
Prescribed fire	native and restored prairie communities	Is prescribed fire regime healthy for the prairie?	plant community composition, habitat heterogeneity, small mammal diversity, nesting grassland bird diversity
Prescribed fire	forest plant communities	Is prescribed fire negatively impacting forests?	plant community composition, woody regeneration, overstory structure.
Prescribed fire	forest and riparian areas, herpetofauna	Is prescribed fire regime negatively impacting herpetofauna?	Distribution/abundance of breeding habitat, abundance, diversity of herpetofauna
Usage			
Poaching/killing of wildlife	alligators	Are local residents, tournament bowfishermen negatively impacting alligator populations	spotlight survey

Table 4. Park ratings of potential monitoring projects for riverway and small parks of the Ozark Highlands Cluster, (BUFF, ONSR; ARPO, GWCA, HOSP, PERI), Heartland I&M Network.

PARK	T&E Species	River integrity (biotic - turtles, fish, macroinvert.)	River integrity (abiotic)	Springs	Geothermal springs	Common plant communities - photomonitoring	Plant communities - unique habitats	Sensitive neotropical migrants	Invasive exotics (distribution)	Invasive exotics (control)	Amphibian breeding habitat	Troglobitic fauna	Ungulate Effects (exclosures)	Land use change (adjacent, watershed)	Usage corridors
BUFF	70	69	69	67		51	65	65	48	48	60	62	44	68	27
ONSR	69	74	71	70		57	70	55	54	51	61	72	41	70	54
average	69.5	71.5	70	68.5		54	67.5	60	51	49.5	60.5	67	42.5	69	40.5
ARPO	57	75	51			50	74	53	65		67		57	47	
HOSP		74	69	63	79		73		65	71	73		44	65	54
PERI	41			54			45		41	39	48		67	43	
GWCA	49	71	47	45		29	66	43	64	47	61		20	49	29
average	49.00	73.33	55.67	54.00	79.00	39.50	64.50	48.00	58.75	52.33	62.25		47.00	51.00	41.50

To accomplish these objectives within target resource monitoring areas, the Ozark Highlands Cluster parks are to receive $355,200 per year, starting in FY2001. There is also the potential to receive approximately $100,000 under I&M water quality funding. Within FY2001, the cluster will begin to address monitoring where established protocols are available, and continue the process of refining objectives and protocols for monitoring target areas where the state of the scientific knowledge is less well- defined.

Based on the existing expertise within the cluster, significant progress has already been in planning for aquatic resource monitoring. Further monitoring design for unique plant communities/animal occurrences, and exotic species needs to be conducted in FY2001 with taxa experts and park staff.

Target Monitoring Area 1: Integrated aquatic resource monitoring

David Mott, hydrologist at Buffalo National River and the NPS Water Resources Division, has drafted an Aquatic Resource Monitoring Plan for the cluster, which integrates watershed land use monitoring, water-quality monitoring, physical habitat monitoring, discharge and stream gauging, and biologic monitoring at the six parks (Table 5). Unique challenges for monitoring within the cluster include geothermal springs, large springs, and long river systems. The monitoring strategy within the Aquatic Resource Monitoring Plan was developed utilizing the National Park Service Inventory and Monitoring Program's *Guidance for the Design of Sampling Schemes for Inventory and Monitoring of Biological Resources in National Parks,* as well as other sources of available information for design of monitoring programs.

Table 5: Concerns and objectives related to high priority monitoring categories recognized by the Heartland Network Inventory and Monitoring Working Group.

Monitoring Category	Concerns and Objectives
Land-use	*Concern* – Water-quality and biological studies have shown a clear relationship between increasing watershed development, higher pollution, and less diverse aquatic communities. *Objective* – Monitor land-use changes as a basis for interpreting the results of physical, chemical, and biological monitoring and to define temporal trends. Land-use analyses will be done at the watershed scale (where practical) and be categorized as forest, pasture, crop, urban, barren, transportation, and water.
Abiotic	*Concern* – Physical processes define and maintain the aquatic habitats upon which aquatic communities have evolved and are maintained. Changes in physical habitats can cause large-scale and potentially irreversible impacts to aquatic communities. *Objective* – Monitor critical indicators of water quality, flow, and geomorphic processes and parameters that effectively define the status and trends of aquatic habitat conditions.
Biotic	*Concern* – Biological communities must be monitored directly because it is not possible to measure everything that might affect living systems. Aquatic organisms are subject to and reflect cumulative impacts that can not otherwise be assessed through traditional water-quality monitoring. Also, visitors and administrators can directly appreciate the loss of biological integrity. *An objective – Assess primary aquatic communities at a level of scrutiny sufficient to detect changes* and quantify trends in aquatic ecosystems.

The two linear river parks appear to have a need for more intensive aquatic resource monitoring - Buffalo National River (BUFF) in northern Arkansas and Ozark National Scenic Riverways (OZAR) in southern Missouri. Both parks are relatively large (>95,000 acres), have annual visitation numbers approaching one million, and were designated specifically to preserve free-flowing river's and diverse ecological communities. Because of their individual monitoring requirements, monitoring staff is proposed to be stationed at both units to focus on the needs of these river-based parks and provide results directly to unit managers. The four other units in the cluster lie within a 150-mile radius of BUFF, and staff stationed at BUFF will serve these satellite parks.

The U.S. Geological Survey has recently developed a National Ambient Water Quality Assessment Program (NAWQA) which developed and tested aquatic monitoring protocols with many of the same goals and objectives as the National Park Service monitoring program. Several NAWQA sites are located within the parks, and the monitoring strategy they employ has provided valuable information for park managers. Therefore, the recommended monitoring scheme utilizes NAWQA Program protocols where appropriate. The monitoring strategy also includes direct assistance from the U.S. Geological Survey where they are uniquely qualified to provide high quality data (e.g. stream gauging). Modifications to the NAWQA protocols have also been made where the parks recognize other monitoring needs, or where researchers have developed superior monitoring tools and/or approaches for park specific needs.

Funding for monitoring in this target area would be utilized as described in Table 6. The sampling scheme will employ a combination of routine long-term sampling, rotated intensive sampling, and short duration synoptic assessments as explained in the schedule section. Biological monitoring will be done in a rotating site manner, with key communities being targeted for a specific interval of years at specific sites.

Table 6: Ozark Highland Cluster Aquatic Resource Monitoring Descriptions and Budget

Monitoring Element	OZAR	BUFF & Satellite parks
1. Water-quality Monitoring – Staff a hydrologist at OZAR (GS 9/11) to supervise and conduct a water-quality monitoring program there. BUFF already has a hydrologist who will coordinate the overall monitoring program and directly supervise monitoring at BUFF and the four satellite parks. Staff a hydrologic technician at BUFF (GS7/9) and a seasonal hydrologic technician at OZAR (GS5) to assist with field and laboratory work at each park, and a seasonal hydrologic technician at BUFF (GS5) to assist with data collection from the other four parks in the cluster. Conduct geothermal spring studies at HOSP. Budget includes money for supplies, meters, travel, vehicles, and analytical contracts. Staff time will also be devoted to other items as stated below.	80 (90)	97
2. Physical Habitat Assessments – The hydrologists at BUFF and OZAR, along with their field staff, install and monitor long-term physical habitat assessment reaches. BUFF team also establishes and monitors habitat assessment sites in satellite parks. Costs in this category include supplies, materials, and travel.	0 (4)	0 (14)
3. Discharge and Hydrographs – Instantaneous discharge measurements will be recorded during all water-quality sampling to allow determination of loads. Intensive sampling sites will also be installed and monitored in each of the parks on	10	20

a rotating basis, with BUFF and OZAR always having at least one continuous recording stream gauge in operation at all times. These gauges will be operated and maintained by the U.S. Geological Survey.		
4. Land-use and Information Management – A Geographic Information Specialist position (GS7/9) will be created at Buffalo National River to manage information and meet meta-data requirements. This individual will also be required to assist with any data analysis needs of any member of the monitoring team (including needs at OZAR and other parks), and to contract with a specialist to conduct land-use analysis on a ten-year rotating basis for each park.	0	0 (65)
5. Biological Monitoring – Seasonal biological technicians will be assigned to BUFF (GS7) and (GS5) and OZAR (GS5) to assist with the field components of the biological monitoring. This team, with assistance from the hydrologic technicians mentioned in Element 1, will be responsible for the biological monitoring needs of all of the parks within the cluster.	15	63 (83)
6. Special projects and contingencies – Funding to be used for leveraging with external funding sources to conduct special studies that more effectively meet monitoring goals 4 and 5 stated previously. Funds would also cover the cost of contingencies that might arise in a given year (such as meter replacement).	0 (7)	0 (12)
Total Costs	105	182
Grand Total	**287,000**	

If the cluster receives the additional $100,000 water resources funding, the priorities are to fund a fully operational Land–use and Information Management program (adequate funding for land-use analysis on a ten-year rotating basis for each park), fund an aquatic ecologist (GS-9/11) to coordinate the biological monitoring program for all parks, conduct physical habitat measurements, and provide for special projects and contingencies at the levels contained in the parentheses for each element.

Unique plant communities/animal occurrences, and exotic species

The four compact parks of the cluster identified monitoring of unique plant communities, amphibian breeding areas, and exotic plant species as important for their parks. Available funding allocation for these activities has been applied only toward vegetative communities, as follows:

Park	Vegetation communities (unique or exotics)
HOSP	6500
PERI	30000
GWCA	2700
ARPO	7000
Total	**70500**

During FY2001, the cluster will further refine the objectives and protocols for this monitoring. If additional funding is sought, the priority is to add monitoring of amphibian breeding areas.

Network Support

Implementation of both the inventory and monitoring components within the Heartland Network will require a Network Coordinator (GS-11) and a Data Manager (GS-11) , with a location to be determined. Funding support for these positions will be provided at the Network level, and determines the funding available for each cluster. Both of these positions will assist each cluster, seeking to leverage funding to fully fund the monitoring projects, and providing data management and information transfer support.

Summary

- The Ozark Highlands Cluster of the Heartland Network has completed the inventory planning portion of the NPS I&M program, and has commenced planning for the monitoring component.

- Based on a Network workshop in March 2000, the target natural resources monitoring areas within the cluster are:
    - aquatic resource quality
    - unique/endangered plant communities and animal occurrences
    - invasive exotics

- The cluster will receive approximately $355,200 per year to address monitoring plans, implementation, and data management. There is also the potential to receive approximately $100,000 under I&M water quality funding.

- Existing expertise within the cluster has developed an Aquatic Resource Monitoring Plan to address the target area of aquatic resource quality. Funding budgeted toward implementing portions of this plan is $287,000. It is underfunded by $145,000.

- Remaining funding for the cluster has been directed toward vegetative community monitoring within 4 parks at a total of $70,500.

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